Midwest Engineer

SERVING THE ENGINEERING PROFESSION

WESTERN SOCIETY OF ENGINEERS
FOUNDED 1869

1955-56 WSE PRESIDENT ALBERT P. BOYSEN

OUT OF THIS WORLD—PAGE THREE

Vol. 8 JUNE, 1955 No. 1

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Western Society of Engineers

84 E. Randolph Street
Chicago 1, Illinois

MIDWEST ENGINEER
Published Monthly
BY
THE WESTERN
SOCIETY OF ENGINEERS
AT
84 EAST RANDOLPH STREET
CHICAGO 1, ILLINOIS

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The Society does not assume responsibility for statements and opinions in articles, papers and discussions appearing herein. All material must be submitted on or before the 10th of the month prior to date of publication.

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Single Copy ....$ .50
Annual subscription 4.00
Foreign subscription.................................... 6.00

Entered as second-class matter at the post office at Chicago, Illinois under the Act of March 3, 1879.

Midwest Engineer

A Publication of the

WESTERN SOCIETY OF ENGINEERS

Serving the Engineering Profession

JUNE, 1955 Vol. 8, No. 1

CONTENTS

COVER STORY

Albert P. Boysen, the new president of the Western Society of Engineers, appears on the cover of this issue. Mr. Boysen is division engineer of the American Bridge Division of the United States Steel Corporation. His engineering education was unusual in that he received it by attending the Armour Institute of Technology, at night.

Mr. Boysen became a member of the Western Society of Engineers in 1931. An active member, he has been chairman of the General Program Committee and the Bridge and Structural Engineering Section, and a member of the Admissions Committee. During the last fiscal year Mr. Boysen was the Society's first vice-president.

Cool Comfort

Eat and Relax

in the

WSE Dining Room Lounge-Bar

For the comfort of our members and guests — during July and August, WSE is providing a lounge-bar on the dining-room floor (5th).

Sandwich Luncheons

Petite Buffet

All the coffee you can drink!

Come in and try the new set-up

A Discussion of the Engineering Problems of Space Travel

Out of This World

By Stephen J. Fraenkel

Space travel, when it will be successfully accomplished, will represent the greatest departure from man's previous existence within his past experience and history. The very novelty and implications of this possibility generate the fascination and the interest with which this subject is being viewed. Despite the overall complexity of the subject, the first question which one might ask about space travel is simple:

. . . Why? . . .

Actually, this question is rather readily answered on many different counts. Above all, there is the "romantic" appeal of space travel, which is somewhat akin to that of mountain climbing and deep sea exploration. The penetration of new areas which present a challenge, by their very existence, represents satisfaction and achievement to the inquisitive human mind. Beyond this, there are, however, many reasons why space travel may advance many existing areas of human endeavor. Among these, scientific reasons may be cited; for example, the need for a more far reaching exploration of the heavens and for a better understanding of the material universe which surrounds us. It is obvious that an observation platform in space would enable us to make astronomical observations and measurements of far greater significance than can be made at the bottom of the atmospheric ocean at which we are now living. Of similar importance would be the improved understanding of radiation phenomena from which we are now partially shielded by the atmosphere in general and by the layer of ozone within it, in particular. There are reasons why both meteorology and climatology may well benefit from observations made in the upper reaches of the atmosphere and in outer space. A far superior system of weather forecasting and even a means for predicting long term trends in the climate of various regions of the earth could result. Clearly, communications between various points on the surface of the earth could be greatly aided by scientific exploration of outer space. It is well known, of course, that some communications, such as radio, are very definitely affected by sunspots and other extra-terrestrial phenomena, and further knowledge along these lines could very well result in greater reliability and range of established communications systems.

At the present time, the military appeal of a space ship, or of a satellite, cannot be overlooked. The presence of an observation platform which would circle the earth, for example, and place every spot on its surface under constant surveillance might be, in itself, the greatest deterrent to war yet devised.

. . . What Is Space? . . .

Let us examine, for a moment, the definition of space. First of all, space is not clearly differentiated from the atmosphere and does not begin suddenly at a certain altitude. The onset of space varies with altitude, depending on the phenomenon under study. At the present time, certain military aircraft are already able to fly at such altitudes that, as far as the body of the pilot is concerned, he is already in empty space. In general, however, one may consider the region above 200 miles altitude to be representative of empty space, as far as the manifestation of physical phenomena is concerned. It should be noted that man-made objects have actually reached, and returned from, a height of 250 miles and have thus successfully entered the region of empty space. This feat was achieved with an unmanned WAC Corporal V-2 2-step missile, which contained scientific instruments, from which much hitherto unknown information regarding conditions at that altitude was obtained by telemetering. With this thought in mind, the problem of eventually establishing a satellite or leaving the earth entirely does not seem quite as forbidding as one might at first believe.

. . . Engineering the Spaceship . . .

Structure

In addition to the conventional engineering considerations which enter into the design of any vehicle, an unusual problem is created by the acceleration loads encountered upon take-off. Because it is economical of fuel to initiate travel with the highest possible velocity so as to avoid the carrying of fuel for greater distances than necessary, high initial accelerations are desirable. These accelerations may be expected to range between five and ten gravity units and would, therefore, superimpose upon the spaceship structure a load equal to 5 to 10 times its own weight. It is obvious that this would place rather severe demands upon the integrity of any structure.

The problem of successfully coping with the temperature rise induced by friction with air is likely to be a severe one. It is precisely the requirement of starting with the highest possible velocity which produces trouble by causing the ship to traverse the denser portion of the atmosphere at high speed, thus leading to high aerodynamic friction. Thus, the requirement arises that the materials of the spaceship be adequate for withstanding temperatures in the skin probably exceeding 1,000 degrees Fahrenheit and that the interior be adequately insulated. Present materials, both metallic and non-metallic, place

Dr. Fraenkel, manager of Propulsion and Structural Research Department, Armour Research Foundation, Chicago, presented this talk on Feb. 1, 1955 before the Western Society of Engineers at the Society's headquarters in Chicago.

some very definite limitations on permissible temperature rises, and there is a general expectation that few existing materials, if any, will retain adequate strength at such high temperatures.

Another unusual specification for the structure of the spaceship relates to its resistance to meteorites. These fragments can be expected to impinge in great numbers on a spaceship, or a satellite. Meteorites are believed to be generally small in size, but they are travelling at speeds of thousands of miles a second. The impact of these meteorites must not be permitted to destroy the skin of the missile, and any punctures must be promptly repairable from within a manned missile. The explosive decompression following a break in the skin would be disastrous to a crew and to instruments in an unmanned vessel alike.

Still another problem is posed by a returning spaceship, or satellite of a temporary nature. It is not economical to break the fall of such a missile by expending fuel, since one would theoretically need an amount of fuel for this purpose equal to that required for launching. It is therefore considered advisable to rely on atmospheric braking to slow down the returning ship. Such braking would have to be done in very careful and slow stages, since the heating of the ship's structure would, otherwise, grow out of control. Even with the most careful programming, it is anticipated that a returning ship will be heated to between 1,000 and 1,500 degrees, a temperature at which ordinary steel would become red to white hot. Prolonged exposure to temperatures of this magnitude would clearly raise an even worse problem than friction during the ascent.

Power Plant

It is obvious that only a rocket, a reaction motor which kicks itself ahead by its own exhaust, can be operable under space conditions. No other motor is independent of the ambient atmosphere and of its oxygen, in particular, and only a rocket will, in fact, gain efficiency as its surroundings approach a vacuum. In order to pin-point the significant factors in the efficiency of a rocket engine, the following relation is useful:

$$\frac{M_f}{M_e} = e^{v/c} \text{, or}$$

$$v = c \log_e \frac{M_f}{M_e} \text{, where}$$

M_f = mass of full rocket at take-off
M_e = mass of empty rocket after all fuel is consumed
v = velocity of empty rocket after consumption of fuel
c = exhaust velocity of combustion products

These relations, which ignore gravity and air resistance, show that a high mass ratio, M_f/M_e, is desirable, the achievement of which is an engineering problem. It is also seen that a high exhaust velocity is desirable. The latter is a chemical problem relating to the composition of the propellant.

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Above: In-coming President Albert P. Boysen at the speaker's stand.

ANNUAL DINNER

The Biggest Ever

On June 7, 1955, John F. Sullivan, Jr., out-going president of the Western Society of Engineers, called the 86th Annual Meeting of the Society to order. It was the largest such meeting ever held.

After introducing the persons seated at the speaker's table, Mr. Sullivan said, reviewing the work of the Society during the fiscal year:

"The work of the Society is carried on by 11 Technical Sections and 17 Committees. During the past year the Sections, which represent the various branches of Engineering, arranged some very interesting technical meetings while the Committees carried on other important activities.

"In reviewing the many annual reports submitted by the Section and the Committee chairmen, one cannot help but be impressed with the time and effort spent by members involved in their work.

"During the past year, our Society has continued to progress.

"We raised sufficient funds to pay off the amount due the contractors in connection with the headquarters expansion and improvements.

"Under the leadership of Tom Ayers over 100 young Engineers were enrolled in our Young Engineers Forum. This program, I feel, is one of our most important activities. The outstanding speakers and the enthusiastic response of the young Engineers, easily made this, our outstanding Forum.

"Myron Lukey's Membership Committee obtained over 200 new members which provided plenty of work for Vince Nass and his Admission Committee."

"The volume of advertising obtained for the Midwest Engineer and Year Book set a new high.

"185 Engineers participated in the various evening courses sponsored by our Educational Committee.

"The Special Events Committee promoted some very successful social events at our headquarters.

"The Program Committee under Andy Snider arranged a total of 58 meetings—including both luncheon and dinner meetings, with an average attendance of 50.

"The Civic Committee, under Dan Chinlund had a very busy year studying a number of Civic Projects and have presented a number of recommendations for the Board's action.

"I could go on giving reports of the accomplishments of the other Committees—let it suffice, however, to say that all of the Officers and Board of Direction greatly appreciate the hours and energy expended by these Committees.

"Mr. Harrington and his staff have been most cooperative, and have continued to render a very fine service both to our membership and to the Technical Societies utilizing our headquarters facilities."

At the conclusion of his report, Mr. Sullivan proceeded to make the presentations. The first was a Life Membership Certificate given to Lyman L. Browne. E. R. Hendrickson, who was chairman of the Committee, was given a Service

Award for his outstanding performance in obtaining advertising for the Midwest Engineer magazine, and for the Year Book. R. M. Smith was given a Service Award for his excellent work in planning and conducting WSE Special Events. He had been chairman of that committee.

Two more Service Awards were presented by Mr. Sullivan: one to T. D. Hartsell for his fine work as chairman of the General Education Committee in developing and conducting the Western Society's Educational Program. Dean O. W. Eshbach, chairman of the Special Library Committee, was honored by an award for, to use Mr. Sullivan's words, "perseverance and success in selling the WSE Library under very favorable conditions."

Continuing with the program, Mr. Sullivan said:

"Recently, the Illinois Engineering Council decided to present a Certificate to its Past Presidents. The Council is composed of representatives from 18 Technical Societies in the state and was responsible for the passage of the Illinois Professional Engineering Act. It continues to look after the interests of the Engineers so far as legislative matters are concerned. Back in 1942, during the formative years of the Council, Mr. T. G. LeClair, a delegate from the Western Society of Engineers, was President of the Council." Mr. Sullivan then called Mr. LeClair to the stand and said: "As one Past President to another, it is a pleasure to present you with this Certificate."

He then continued:

"This year the Society is granting two Honorary Memberships.

"The first is awarded to General Douglas MacArthur. General MacArthur graduated from West Point in 1903 with the highest academic record ever attained, and was commissioned a Second Lieutenant in the Corps of Engineers. His first engineering assignment in the Army took him to the Philippines. After a few year's duty he returned to West Point and graduated from the Engineering School of Application in 1908. Following this he had a tour of engineering duty in Milwaukee and remained in the Corps of Engineers until August, 1917, when he was promoted to a Colonel and transferred to the Infantry. After one of the most brilliant military careers in the history of our country, he returned to engineering in an administrative capacity as chairman of the Board of Remington Rand, one of the leading manufacturers of specialized electronic equipment.

"General MacArthur requested that Colonel Hoy D. Davis, head of the Fifth Army Engineering Section, receive the Honorary Membership Certificate for him in his absence." Colonel Davis then received the certificate for General MacArthur.

"Our next recipient," said Mr. Sullivan, "presented somewhat of a problem. When he was notified of his election to Honorary Membership, he agreed *but* on the condition that he could edit what I had to say about him.

"He is Mr. H. P. Sedwick, executive vice-president of Commonwealth Edison Company and president of the Public Service Company. Mr. Sedwick is an electrical engineer from the hills of Arkansas, receiving his education at the University of Arkansas. I am identifying him in this way because so many of you know him by his own statement as an "Arkansawyer."

"He started with the Public Service Company in 1913. In 1922, after considerable field experience in engineering, operating and commercial work, he joined the staff of Mr. J. L. Hecht, vice-president in charge of operations—and likewise an Honorary Member of this

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"Mnemotron" Memory Is Now In Operation

Early in May, the "Mnemotron," the world's largest ferrite core memory began operation in Los Angeles. The Mnemotron (pronounced without the "M"— *NEE-MOH-TRON* and meaning "memory device") is able to "memorize" and "recite" at the rate of over 50 full-length novels every minute. Installed in the RAND Corporation's electronic computer, it will have the job of remembering data needed in high-speed computation.

Completed after two years of research and development at International Telemeter Corp., a subsidiary of Paramount Pictures Corporation, the memory consists of 170,000 ferrite-cores and the electronic circuits for getting information in and out of them. In these circuits there are 1207 tubes.

What Does This Memory Do?

Mnemotron *does not* perform a function analogous to your own memory. Instead, it takes the place of the scratch pad you use when you do arithmetic problems. It remembers the numbers involved in various steps in a computation and furnishes them when they are needed in further steps.

For example, when you figure compound interest on $100 at 6%, you multiply $100 x .06, write down the result, add it to $100, write down the result, multiply the result by .06, etc.

In a large electronic computer, the memory stores many of the things you would write down. The electronic arithmetic circuits in such a memory can perform simple arithmetical operations such as addition and multiplication with great speed. A limiting factor in the speed of these machines has always been the time it took for the machine to write information into the memory, to locate a desired item of information in the memory and to read information out of the memory.

When you calculate compound interest, the time it takes you to write 106 is relatively small compared to the time it takes for you to multiply 106 by .06. In the computer this time is relatively large, and anything which can be done to decrease it speeds up the whole machine.

How Does the Memory Compare with Previous Memories?

In most devices previously used for this purpose, the items in the memory kept passing some output point in a fixed sequence. If the computer wanted to get any item, it had to wait till that item passed the output point. These devices could be compared, in a way, to lazy susans. The rest of the computer had to sit at some point on the periphery of the lazy susan waiting for the caviar to pass.

Unlike such devices, the ferrite core memory has what we call random access; that is, anything in the memory can be reached instantaneously. There is no need to wait for other things to go by.

There is another way in which this memory is better than the old kinds. Several types of previous memories did not have the difficulty mentioned above; that is, you did not have to wait for the item you wanted to pass you.

These memories, however, had a more serious problem; they forgot things almost immediately. Information stored in these memories would fade out in a tenth of a second, or even less. Therefore, with such memories, cumbersome electronic circuits had to be provided to remind the memory to start remembering all over again what it was about to forget. Further, these devices tended to be unreliable.

The ferrite core memory does not have this difficulty. Information stored in it will remain stored forever unless the appropriate electronic circuits substitute some other information for it. In other words, ferrite cores forget only when they are told to.

To summarize this very briefly, the Mnemotron combines rapid random access with permanent retentivity. Also it has no moving parts.

How Fast Is It?

To find any item on this scratch pad takes 8 millionths of a second. To find an item, read it and write an item takes 15 millionths of a second. In layman's terms, the machine is capable of reading back from the memory approximately seventy thousand English words or writing into the memory another seventy thousand English words in one second. To put it more succinctly, the machine is capable of reading one English novel a second.

"Read" here means that the memory gives information back to the computer, and "Write" means that the computer puts information into the memory. Obviously, the computer will never take an English novel and put back another in one second. But, it will regularly handle equivalent amounts of information in this way.

Physically, How Does the Memory Remember?

You are acquainted with magnets and magnetic compasses. These devices have a certain direction of magnetization. A compass needle, which is a small magnet, always points to the North. Actually, this small magnet is remembering which way is North. If we were to take it, and in some way reverse the poles of the magnetic needle, the side which previously pointed to the North would now point to the South. We would have written a different item of information into it.

When the needle is magnetized so that one end is the North Pole and one end is the South Pole, we say that magnetic flux runs through it in a certain direction. If we now take this needle and bend it into a circle and connect the North Pole to the South Pole, a funny thing happens.

There is now no North Pole and no South Pole because there are no ends. The magnet is now a closed ring. The magnetic flux still exists in this closed ring and may run either in one direction or the other, just as it did previously.

Such a ring is the basic information storage unit of the magnetic memory. If the flux within the ring runs in one direction, we say the ring stores a ONE. If the flux runs in the opposite direction, we say the ring stores a ZERO.

Actually, we say ONE and ZERO because it is convenient to talk in terms of these numbers. We could also call one direction of magnetization a dash, and the opposite a dot. And for certain uses, there would be nothing to prevent us from saying that a ring storing a dot followed by a ring storing a dash represented an A, just as a dot followed by a

dash does in the Morse Code. You can easily see that if we had enough of these rings and if we had some way of instantaneously recognizing the direction of magnetization of every ring, we could remember a large amount of information.

In practice, the rings are made of ceramic material. A mixture of iron ore, magnesium and manganese oxides is baked to form the individual ferrite cores. This ceramic material is used because it has magnetic characteristics suitable for the purpose. It can be magnetized instantaneously, and once magnetized, it remains in this state indefinitely.

How is Information Read and Written in the Memory?

Reading information from the memory consists, essentially, in determining in which direction the ferrite core being examined at the moment is magnetized. This is done very simply. Three wires run through each core. A current is passed through two of these wires. If the core is magnetized in one direction, there will be only a slight change in its magnetic state.

If it is magnetized in the opposite direction, the effect of the current will be to demagnetize it completely and then reverse the direction of magnetization. When this happens, the core will induce a current in the third winding, called the reading winding. The absence or presence of this current in the reading, therefore, is an indication of whether the core was in the ZERO or the ONE state.

How Do You Know Which of the 170,000 Cores in the Memory are Reading ZERO or ONE at Any One Instant?

Two of the windings pass through each core at right angles to one another. Each of these windings carries one-half the current necessary to produce an output from the core. Therefore, the only core which will get enough current for an output is the core at the junction of two lines, both of which are being pulsed. If you think of these lines as streets going in one direction, and avenues going at right angles to the streets, you will see that a given core has to be on the right street and the right avenue in order to get the two one-half currents necessary for a reading.

In the Mnemotron, the streets are referred to as X lines and the avenues as Y lines. On each matrix there are 32 X lines and 128 Y lines. Therefore, there are a total of 4096 cores in each matrix, one core at each juncture of an X and Y line. There are also four extra Y lines which can be switched into the circuit in case of damage to any one of the cores.

In the Mnemotron there are 40 such matrices. A complete word consists of the information stored in every core in the same location on each of the 40 matrices. For example: if the first bit of information is stored in a core located at the juncture of the third X line and the fourth Y line on the first matrix, the second bit of the word will be stored on the third X line and the fourth Y line on the second matrix, etc. All 40 bits in

the word are read or written simultaneously.

How Can You Speak of 40 Bits in a Word?

It was mentioned before that each core is capable of storing only a ZERO or a ONE. Actually, when you get right down to it, all each core can do is be magnetized one way or the opposite way—just like the compass needle. Computer engineers think of such devices as the simplest possible containers of the most basic unit of information. They call this unit of information a *bit.*

All that the word *bit* means is ONE or ZERO or (Yes or No.) Any other information can be measured in terms of a certain number of bits (or of Yeses or No's). In the game of Twenty Questions, the person playing the game has 20 bits available to him. That is, he can ask 20 question and get answers of yes or no each time.

Actually, with 20 bits, he is mathematically able to pick one item out of a million. Six bits are sufficient to communicate all the characters which would ever be necessary in printing a book. Since the average English word is about five letters in length, 30 bits would be sufficient to communicate the average English word. In the RAND memory, because of the needs of the computer, a word is 40 bits in length.

The term "word" is used here not in the usual sense, but simply to define a certain number of bits that go together as a group. With 40 bits, the largest decimal number possible is a million-million.

What Other Plans Does International Telemeter Have for These Cores?

At the present time ITC has contracts to produce such memories for the Ballistic Research Laboratories at the Aberdeen Proving Ground, the Argonne National Laboratory, and for the Weizmann Institute of Science in Israel. International Telemeter has already produced, on an experimental basis, in its laboratory, matrices of over 32,000 cores. With such matrices, memories of ten times the size of the RAND memory are easily possible.

Industry Is Helping Students

Industry is making it increasingly easy—financially speaking—for students to obtain a college education at Illinois Institute of Technology.

It is being done through Illinois Tech's cooperative education program in which a formal education is combined with practical experience in a student's specialized field.

One hundred and eleven IIT students—more than ever before—are enrolled in the program, according to Raymond D. Meade, director of cooperative education at the Institute.

He said 31 Midwest industrial firms currently are participating in the program and about 300 more are on the waiting list.

"The biggest difficulty seems to be in finding enough interested and qualified students to accept the opportunities offered by industry," Meade pointed out.

Under the co-op program, he explained, a student attends Illinois Tech for two semesters, then spends the third semester working full-time for an industrial firm at a job related to his field of study.

Thereafter, the student spends alternating semesters attending classes and working in industry until he earns his degree, which usually takes about $5\frac{1}{2}$ years.

The support given by industrial firms varies from pay when employed to full tuition plus wages.

Meade blames the shortage of co-op student participants on two factors:

"First," he explained, "is the large number of companies eager to sign up for the program. It is a case of the demand exceeding the supply."

Meade said many companies have been impressed by the fact that 80 per cent of past students in the program have stayed on with their sponsoring company after graduation.

"Secondly, many students have not taken advantage of the opportunity because it takes them $5\frac{1}{2}$ years, instead of the usual four, to obtain their degree. They think they are falling behind the other students.

"But this is not true," Meade emphasized. "Our studies show that students in the past who have gone through IIT on the co-op plan earn \$50 to \$100 more in starting salaries per month after graduation."

High school seniors interested in the co-op program should write to the Director of Cooperative Education, Illinois Institute of Technology, 3300 Federal street, Chicago 16.

A Thought . . .

An honest man's word is as good as his bond. —Cervantes

EJC Elects AIIE a Member

Engineers Joint Council has announced at its headquarters in New York the election of The American Society of Refrigerating Engineers as a constituent society. It also announced the election of the American Institute of Industrial Engineers as an associate, the first organization to become an EJC associate.

EJC now has nine constituent societies with a total membership of more than 196,000. Other organizations in EJC are American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, American Water Works Association, American Institute of Electrical Engineers, The Society of Naval Architects and Marine Engineers, American Society for Engineering Education, and American Institute of Chemical Engineers.

Objectives of EJC are the advancement of the general welfare of mankind through the available resources and creative ability of the engineering profession; cooperation among the branches of the profession; advancement of the science and profession of engineering; development of sound public policies in national and international affairs wherein the profession can be helpful through the services of members of the profession.

EJC has been taking steps toward increasing the unity of the engineering profession. A total membership of at least 5,000 is required of a national organization to qualify for constituent membership. The American Society of Refrigerating Engineers, which has headquarters in New York City, has more than 6,200 members. A recent constitutional amendment permits EJC to admit as Associates national organizations of less than 5,00 members. The American Institute of Industrial Engineers has some 3,000 members. Its headquarters are in Columbus, Ohio.

Thorndike Saville, dean of the College of Engineering, New York University, is president of EJC.

EJC is sponsor of a Nuclear Congress of Engineering and Science to be held in Cleveland, Dec. 11-17, 1955, with twenty-three national organizations participating.

'Interlingua' Speaks for Itself

"Interlingua," a written international language for the communication of scientific information is demonstrated in a special issue of Stanford Research Institute's news bulletin "Research for Industry" which was distributed abroad the week of Apr. 4, 1955.

Interlingua was introduced in 1951 by SCIENCE SERVICE and this issue of "Research for Industry" marks its first use in a general scientific periodical.

The issue featured an article on industrial applications of solar energy and news of the World Symposium on Applied Solar Energy to be held Nov. 1-5 in Phoenix, Ariz., under sponsorship of the Institute and the Association for Applied Solar Energy.

The eight-page issue was printed entirely in Interlingua, which uses words major languages of the West have in common. Operating with a minimum of grammatical factors, Interlingua is said to be understood at sight by anyone able to read technical material in any major European language.

The Interlingua issue is being distributed to SRI's foreign mailing list. Interested persons may obtain additional copies by writing "Research for Industry," Stanford Research Institute, Stanford, Calif.

Out of This World

(Continued from Page 4)

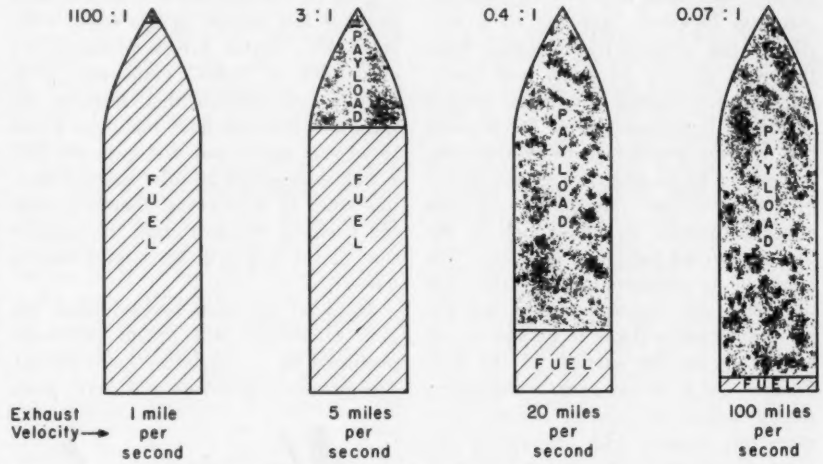

Figure 1. Fuel required to escape earth.

Figure 1 illustrates the effect of varying exhaust velocities c upon the mass ratio, presented in terms of relative payload and fuel weights, for a given rocket velocity v, taken here as the velocity of escape from the earth, which is about 7 miles per second. A typical value of c for representative fuels is 1 mile per second; in that case, the required mass ratio becomes e^7 or 1,100! This means that more than 99.9% of the weight of such a ship must consist of fuel—an impossible requirement, of course. Figure 1 illustrates the rapid reduction of the mass ratio with increasing jet velocity, but, unfortunately, fuels with such exhaust velocities have not been discovered as yet. These circumstances point to a step rocket, or piggy-back arrangement, as the only practical solution within the immediate future. In a multi-stage system, the combined mass ratio is simply the product of the mass ratios of the individual stages. Rockets having individual mass ratios of 4 can be built and, when compounded in five different stages, would reach a combined mass ratio in excess of 1,100, which would be adequate for propelling a missile out of the gravitational field of the earth. Current thinking on this subject is fairly unanimous on the need for utilization of the multi-stage system, and the practical feasibility of such an arrangement.

Two types of chemical fuels have been employed for propulsion purposes. Solid propellants have been used for many years in military applications; their properties are reasonably well understood, but they have the very great drawback of being uncontrollable as far as their combustion is concerned. In other words, once ignited, these fuels will burn, and there exists no readily available means of controlling the rate of reaction. This is a tremendous disadvantage which does not afflict liquid propellants which suffer, however, from other properties, some of which are annoying, to say the least. In fact, even the basic thermodynamic properties of liquid propellants are little understood at the present time. They have, however, the incalculable advantage of being able to cool the combustion chamber before they are burnt within it, and lend themselves to being valved, metered, and controlled. It is this possibility of controlling the flow of liquid propellants that makes them the outstanding candidates for chemically-powered space vehicles. They are generally composed of separate fuels and oxidizers, with alcohol and liquid oxygen serving as a typical combination. Most liquid propellants have to be kept refrigerated prior to use and are both toxic and inflammable, thus requiring extreme precautions in their employment.

Guidance and Control

The first problem in control arises at the moment of take-off. A missile, presumably placed vertically at take-off, moves very slowly at first. During this period, it must be stabilized by gyroscopically controlled vanes, which are exposed to the jets emanting from the rear of the rocket, and which can be deflected to provide the necessary stability for the missile. In flight, at least, the theoretical possibility would seem to exist that spinning of the missile could

be depended upon to provide gyroscopic stability. However, spinning of a missile is not necessarily tolerable from the point of view of safety and operability of complicated equipment carried within. If human occupants are present, this solution would become unworkable, of course. As an alternate means of stabilization in the atmosphere reliance could be placed on fins, much in the manner of old-fashioned airships. This might be an adequate means within that portion of the atmosphere at which the air is sufficiently dense to be able to act effectively on the surface of the fins. Farther out in space, such a stabilizing device would, of course, become progressively useless. The orientation can always be changed by rocket action, if the line of force is properly chosen.

As far as navigation in space is concerned, reliance will have to be placed on astronomical observations to derive information on the rocket ship's location, direction, and speed. Both radar and visual observations could be relied upon to provide a navigational system in outer space. If the supply of fuel were not such a critical factor, there would seem to be no real problem in successful navigation in space; it is only the consequences of an error in navigation, calling for an expenditure of scarce fuel to correct the error, which makes very stringent demands on the accuracy of any navigational system.

. . . Putting a Crew Aboard . . .

An entirely new set of requirements arises if we wish to design a manned ship which gives assurance of a safe return. Our problems begin at the moment of launching due to the limited ability of the body to withstand acceleration loadings. This ability depends upon the position of the human body with respect to the direction of acceleration. In any event, it is doubtful whether accelerations greater than 5 to 7 g can be sustained for more than a few seconds without serious injury. It is for that reason, primarily, that take-off accelerations may well have to be limited to such values, despite the resulting inefficiency in fuel consumption.

The stablity of the course of a rocket ship is of serious concern in connection with the safety of the crew. For example, the motion of a ship traveling at the velocity of escape, about 35,000 ft./second, on an arc of 350 mile radius would impose a lateral acceleration of about 20g on its inhabitants. It does not seem possible that human beings could withstand the inertia forces produced by even such a "mild" maneuver. It is equally well known that missiles designed in the past have not been found to be very stable and that even the V-2, a well engineered missile, has a notorious spin. It is obvious, therefore, that the problem of controlling the orientation of the ship will be a most serious one.

Many of the most commonplace human endeavors will create particular problems in a weightless environment. The presence of fumes and toxic gases from such activities as breathing, or cooking, will present problems unheard of on the surface of the earth. The oxygen-carbon dioxide cycle, which replenishes the oxygen supply through photosynthesis on the earth, will have to be duplicated to provide the crew with an adequate supply of oxygen. Rather ingenious systems have been suggested for overcoming this problem, including the provision of certain plants, which, upon being irradiated by the ever present sunlight, could provide adequate oxygen for the crew.

The most significant change from normal conditions will be the condition of

weightlessness. Not only are the immediate effects of weightlessness upon the human body of importance, but the indirect effect, such as the lack of convection necessary for carrying away exhalation products, the impossibility of drinking liquids in a normal manner, may be of even greater significance. It is conceivable, for example, that a person could in an extreme case suffocate in the products of his own exhalation.

A factor of vital significance is the maintenance of adequate pressure within the spaceship itself. It is obvious that exposure to the ambient pressureless condition would cause immediate boiling of the blood and instantaneous death.

Of equal significance are the thermal effects of exposure to solar radiation. It has been estimated that aluminum plate will rise to a temeprature of around 800 degrees Fahrenheit on that side of the ship which is exposed to the sun, whereas, an aluminum structure in the shadow will be at a temperature of approximately minus 275 degrees Fahrenheit. Of course, the entire spaceship is subject to this tremendous gradient in temperature; but every human being venturing outside the ship for repairs or independent exploration would be subject to a similar temperature differential.

Perhaps the most significant problem, and, alas, the least understood, in preserving human life, under these unusual conditions, is that of the effects on the human body of radiation received from outer space. Although our knowledge of the effects of cosmic radiation on human physiology is extremely fragmentary, it is believed that the effects of cosmic rays are largely detrimental. Cosmic rays have been found, at sea level, to cause ionization of tissues and their eventual destruction and have been observed to pass through a shield of lead one inch thick. How much more serious these problems are likely to be in space, without the absorbing and protecting effect of the atmosphere, and, very likely, without the benefit of one inch of protective lead, can only be surmised. It is very probable that it is this problem which will interpose the greatest difficulty in successfully planting man's feet in space and have him tell the story upon his return.

. . . Where and When? . . .

It is always intriguing to venture a few guesses as to the probable time table of the development of spaceships. It does not seem unreasonable to guess that the placing of an unmanned, but very small, satellite in space could be accomplished in the next five to ten years. It would seem possible to follow this initial step with the establishment of a space station of substantial size, but still unmanned, within the next quarter century, which might carry additional instruments, and a virtual observation platform into the sky. Such a satellite could be arranged to circle the earth in many ways, and at many different distances from the earth's surface. Some possible orbits with their altitudes and periods are shown on Figure 2. A satellite could circle the earth at the equator, for example, at a speed equal to the speed of rotation of the earth at that latitude. At 22,000 miles altitude, the satellite would then remain at a fixed position in the sky; it would be, truly, a man-made star which would never change its position relative to the earth. At the next stage, and perhaps 20 years further away, a manned satellite could be attempted.

The exploration of space beyond the "vicinity" of the earth may require yet an additional quarter century. The moon, and possibly Mars, would seem to be the only inviting destinations within the solar system. The other planets closer to the sun would be too hot for comfort, and those farther from the sun would be both too cold and too

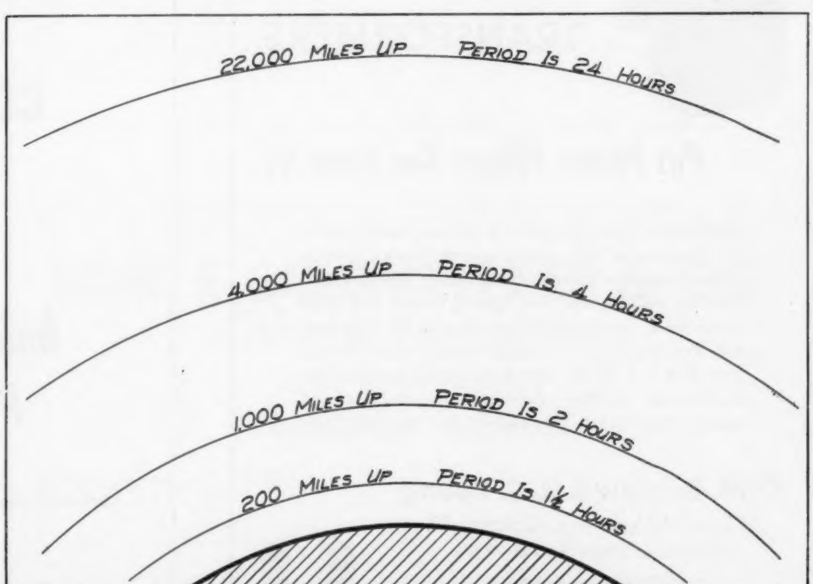

Figure 2. Altitudes and periods for satellite orbits.

far away to permit trips on chemically-powered vehicles within a normal life time. Such trips would have to await the devising of an atomic engine, which employs the direct application of nuclear power to the reaction process. If such an engine were in existence, and especially if it could be planned to travel at speeds approximating that of light, the exploration of other solar systems may not be out of the question. The almost incredible possibility exists that, as far as the spaceship's crew is concerned, and with such high speeds of travel, time would shrink compared with earth time, so that a traveler returning from another solar system would find himself aged only a fraction of the time which his less fortunate contemporaries on earth would have seen pass. Mention of such possibilities appears to belong to the science fiction category—yet, this expectation is based on the best current understanding of the physical universe. Truly, man's greatest adventure is only just beginning and the engineer's greatest challenge still lies ahead.

Planetarium Is Being Modernized

The Chicago Park District Board of Commissioners and the members of the Adler Planetarium Trust have announced a complete modernization program, which will take approximately five years and cost $265,000. This program will include the removal of the present inner dome and the installation of a new and more elaborate one. In the lecture hall a new lighting and sound system, electrical control board, and an entirely new seating arrangement with the latest type theatre seats will be installed.

The Adler Planetarium and Astronomical Museum was the first institution of its kind in America. It was the gift of the late Max Adler and is operated and maintained by the Chicago Park District.

The building houses the famous planetarium instrument which was developed by engineers of the Carl Zeiss Optical Works of Jena, Germany. Since the establishment of the Adler Planetarium six similar planetarium instruments have been brought to this country but the museum building remains unique in design.

An imposing building of rainbow granite with copper dome, the Planetarium is located at the end of Northerly Island in Lake Michigan, a few minutes from the "Loop," and within walking distance of the Chicago Natural History Museum and the John G. Shedd Aquarium in Grant Park. It is dodecagon, or twelve-sided in shape, and at the twelve exterior corners are bronze plaques of the twelve signs of the zodiac executed by the famous sculptor Alfonso Iannelli.

The circular planetarium chamber occupies the central portion of the building and around the chamber are the museum corridors, lecture room, offices and library. In addition to other rooms the lower floor is equipped with a lecture room seating 160 persons. A promenade deck around the top of the building offers a vantage point for viewing the

skies on clear evenings and an unequalled view of Chicago's skyline.

The planetarium building was designed by Ernest A. Grunsfeld, Jr., and won for him the 1931 gold medal of the Chicago Chapter of the American Institute of Architects.

By means of the planetarium instrument, a huge and complex looking mechanism which is actually a giant stereoptican, all the 9,000-odd stars visible to the human eye under perfect viewing conditions can be reproduced on the vaulted ceiling of the chamber. Thus the drama of the heavens appears as if by magic as the lecturer manipulates the large instrument to show the skies as they were hundreds of years ago, as they are today, or will be many years hence. Not only the positions but the relative brightnesses of the various stars can be seen.

Each month a different planetarium show is scheduled. Current phenomena of special interest in the skies is illustrated when possible.

In the museum corridors surrounding the circular chamber is displayed one of the finest collections of antique astronomical, mathematical and navigation instruments in the world. It is the famous Mensing collection which was started some four hundred years ago by the Strozzi family in Italy and which was acquired intact through the generosity of Max Adler. It includes astrolabes, early telescopes, sundials, globes, armillae and nocturnals, not only valuable as scientific instruments but prized for their beautiful craftsmanship. Some of these items date back to 1479; among them are represented the work of many of the foremost instrument makers of the fifteenth, sixteenth, seventeenth and eighteenth centuries.

To the Mensing collection recent pieces have been added by generous friends. There are now over 800 pieces in the museum exhibit.

The Adler Planetarium was opened in 1930.

The Astronomer's Hobby Corner on the lower floor is devoted to the amateur astronomer. Here he may view small telescopes which he could make himself. The names of companies supplying parts are listed here and complete information is available for assembling the telescopes and for their use. This answers the oft repeated question asked by thousands of persons, "Can I afford to buy or make a telescope for my own use?"

Of equal popularity is the meteor exhibit, a collection of actual meteors, fascinating to the planetarium visitor because it represents an actual bit of the heavens, or something out of the sky which he can really touch. This is one of the first exhibits opened during the current modernization of exhibits and the construction of new astronomical displays. Within a short time it is hoped to have a completely new display on the lower floor, attractively presented and designed to be actual working models, simple and self-explanatory to the layman.

During 1953 attendance at the Planetarium was 317,841. It is believed that part of this increase is due to the airing of weekly radio shows over the Board of Education outlet in Chicago, a series started four years ago. The greatest increase over those years has been noted among school groups of the elementary, high school and university levels. The current program of modernizing the exhibits also accounts for the increase.

For some years it was the practice to add evening shows to the weekday schedule during the summer months. Now with the increased interest in the Planetarium evening shows are presented during the entire year. The Museum is open every day from 10 a.m. to 5 p.m. with shows at 11 a.m. and 3 p.m. on Monday, Wednesday, Thursday and Saturday; at 2 and 3:30 p.m. on Sunday; and evening shows at 8 p.m. on Tuesday and Friday. Admission is 25c. Wednesday, Saturday, Sunday and some holidays are free days.

A trip to the Planetarium chamber is a never-to-be-forgotten event. Here, as the lights dim in the hushed room, as the heavens darken and the stars come out one by one to the accompaniment of incidental music, the visitor loses himself in time and space. It is only when the stars fade from view and the skies brighten to reveal the silhouette of the Chicago skyline that he is brought back to sudden reality. The astronomical spectacle is ended and the lecturer wishes him a cheery "Good Morning!"

Annual Dinner

(Continued from Page 6)

Society. Mr. Sedwick was made a vice-president of Public Service in 1941 and president in 1953. In 1951 he became executive vice-president of Commonwealth Edison Company and is now a director. He had a great deal to do with the gas utility and became the first president of Northern Illinois Gas Company when it was formed to take over the gas business of the Public Service Company. He is president of the John Crerar Library. He is a member of the Board of Trustees of the Illinois Institute of Technology. He is a Past President of this Society, the originator of our Young Engineers Forum, and has played an important part in the long range plans of this Society. He has been the inspiration and has promoted many of the operating practices in the electrical transmission and distribution systems—but," continued Mr. Sullivan, "I think his greatest interest is the training and development of the young engineer.

"Mr. Sedwick," then said Mr. Sullivan, "it is with the greatest pleasure I present to you this Certificate signifying the Honorary Membership in the Society."

Next came the introduction of the incoming president of the Western Society.

"Before presenting your new President," said Mr. Sullivan, "I would like to express my appreciation for the privilege of having served you the past year. It has been a most interesting experience, and I would like to recommend that more of you take a more active part in the affairs of the Society. I would be very remiss if I did not express my personal appreciation for all of the cooperation and help I have received. Your new president has been a very active worker for the Society for many years. I know he will do a grand job—and that you stand ready and willing to help him. Here is your new president—The Division Engineer of The American Bridge Company—Mr. Albert P. Boysen."

Mr. Sullivan then continued with the program by introducing the speaker of the evening.

"When history evaluates the events of the Twentieth Century it will indeed have a most noteworthy list beginning with the invention of the airplane and ending the Lord knows where. Although we are only a little more than half way through this century, it is difficult to imagine anything more dramatic—more beneficial—more powerful—and likewise more devastating than nuclear energy. You have all read or heard of the events leading up to its discovery, and its use thus far primarily for destructive purposes. Tonight, we have as our speaker one of the world's most eminent scientists and one who played a very important part in the development of nuclear energy.

"Dr. Harold C. Urey, while a native Hoosier, graduated from the University of Montana with a Bachelor of Science Degree in 1917. After a few years of industrial and teaching experience he attended the University of California where he received his Doctor of Philosophy Degree in Science in 1923. He was Professor of Chemistry at Johns Hopkins and Columbia Universities until 1940, at which time he was appointed Director of War Research, Special Alloy Materials Laboratories at Columbia and served in this capacity until 1945. He then came to the University of Chicago where he was appointed Distinguished Service Professor of Chemistry in the Institute for Nuclear Studies. Since 1952 he has been the Martin A. Ryerson Distinguished Service Professor of Chemistry. He has published a number of

Above (left to right): H. P. Sedwick, Colonel Hoy D. Davis, John F. Sullivan, Jr., and Dr. Harold C. Urey.

Above (left to right): Dr. Harold C. Urey, H. P. Sedwick, and John F. Sullivan, Jr.

books and scientific articles, and has received a great many citations and honorary degrees, probably the greatest being the Nobel Prize in Chemistry in 1934. It is a pleasure indeed to introduce Dr. Urey who will tell us about the peace time uses of nuclear energy."

Dr. Urey then presented his talk. (It will be published soon in Midwest Engineer.) At the conclusion of the talk, Mr. Sullivan adjourned the meeting.

Seated at the Speakers' Table

Above (left to right): John P. Gnaedinger; Joseph Kucho; Robert S. Hammond; Alf Koflat; and R. H. Hammond.

Above (l. to r.): John T. Rettaliata; Charles F. Murphy; Charles L. Mee; and Fred Hess.

Left (l. to r.): Ovid W. Eshbach; Colonel Hoy D. Davis; Dr. Harold C. Urey; and John F. Sullivan, Jr.

Right (l. to r.): H. P. Sedwick; Albert P. Boysen; and Richard M. Smith.

Below (l. to r.): Theodore D. Hartsell; Titus G. Le Clair; William R. Marston; and Hjalmar W. Johnson.

Below (l. to r.): Robert S. Hammond; Alf Kolflat; Robert H. Bacon; George L. Jackson; and Ernest R. Hendrickson.

WSE Applications

In accordance with the By-Laws of the Western Society of Engineers, the following names of applicants are being submitted to the Admissions committee for examination as to their qualifications for admission to membership into the Society in the various grades, i.e., Student, Associate, Member, Affiliate, etc. All applicants must meet the highest standards of character and professionalism in order to qualify for admissions, and each member of the Society should be alert to his responsibility to assist the Admissions committee in establishing that these standards are met. Any member of the Society, therefore, who has information relative to the qualifications or fitness of any of the applicants listed below, should inform the Secretary's office. The Secretary's office is located at 84 East Randolph Street. The telephone number is RAndolph 6-1736.

163-54 Sherwin Rosset, Electrical Engineer, Rosset Electric Company, 1400 N. Paulina St.

164-54 James M. Hunnicutt, Jr., Traffic Engineer, III, Bureau of Street Traffic—City of Chicago, 225 N. Wabash Av.

165-54 Edward J. I. Davies, Midwestern Representative, James G. Biddle Company, Phila., 20 W. Jackson Blvd. Chicago 4.

166-54 Melvin C. Heck, Assistant Dist. Foreman, Commonwealth Edison Co., 72 W. Adams St.

167-54 James W. Barnett (Trsf.), Assistant Chief Engineer, Lindberg Industrial Corp., 2321 W. Hubbard St.

168-54 Mitchell J. Alster, Chief Engineer & Branch Manager, Erdner Engineering Co., 29 E. Madison St.

169-54 Philip G. Seges, 1004 S. Fourth St. Champaign, Ill. — attending University of Illinois.

170-54 A. M. Fisher, Regional Manager, Westinghouse Electric Corp., Merchandise Mart Plaza.

171-54 Francis D. Hurd, Senior Electrical Engineer, Pioneer Service & Engineering Co., 231 S. LaSalle St.

172-54 Peter D. Beaner, Vice President, Asbestos & Magnesia Materials Co., 2614 Clybourn Ave.

173-54 Leroy H. Johnsen, President, Arthur Johnsen Electric Co., 2649 N. Laramie Av.

174-54 Charles W. Mehuron, Chief Engineer—Power Div., American Maize Products Co., Roby, Ind.

175-54 Don R. Brown (Rein.), Senior Civil Engineer, Sanitary District of Chicago, 910 S. Michigan Av.

176-54 William J. Niemoth, Process Engineer, Continental Can Co., 7600 S. Racine Av.

177-54 John H. D. Blanke, PO Box 142, Barrington, Ill.

178-54 Wesley R. Parker, Installation Engineer, Sloan Valve Co., 4300 W. Lake St.

179-54 William V. Hoier, President, Robt. Gordon, Inc., 21 N. Jefferson St.

180-54 Ronald D. Collins, 7312 S. Green St., — attending University of Illinois.

181-54 Volney B. Leister, Personnel Director, Commonwealth Edison Co., 72 W. Adams St.

1-55 David G. Wisdom, Jr. Designer-Estimator, American Bridge Division, United States Steel Corp., 208 S. LaSalle St.

2-55 Theodore Bronowski, Jr. Designer-Estimator, American Bridge Division, United States Steel Corp., 208 S. LaSalle St.

3-55 Blaine Hoover, (Rein.), General Construction Supt., Illinois Bell Telephone Co., 208 W. Washington St.

4-55 Charles E. Branson, Jr. Designer-Estimator, American Bridge Division, United States Steel Corp., 208 S. LaSalle St.

5-55 Arthur F. LaForce, Assist. Supt., Mechanical Oper., United States Steel Corp., 3426 E. 89th St.

6-55 Philip J. McLaughlin, Field Engineer, Line Material Co., 4700 Lake St.

7-55 Francis M. Rich, General Supt., Inland Steel Co., East Chicago, Ind.

8-55 Andrew L. Poulos, Junior Designer-Estimator, American Bridge Division, United States Steel Corp., 208 S. LaSalle St.

9-55 Paul M. Black, Division Engineer, Public Service Co., Northbrook, Ill.

10-55 Jack B. Castle, Sales Mgr.-Fuses & Interrupters, S&C Electric Co., 4435 N. Ravenswood Av.

A Thought...

The most exquisite Folly is made of Wisdom spun too fine.

—Poor Richard's Almanack

'Shop-Grown' Timber Is Finding Wide Use

America is putting a new kind of roof over its head.

The use of glued laminated timber construction has reached spectacular proportions, according to Leo V. Bodine, executive vice president of the National Lumber Manufacturers Association.

"It is the most dramatic trend in building since the era when skyscrapers mushroomed in American cities," Bodine said.

Three out of four new churches and thousands of schools, homes, stores, supermarkets, auditoriums, theaters, factories and warehouses now exhibit the distinctive architectural forms of "shop grown" timbers, the lumber spokesman said.

Glue lamination frees wood from limitations of size and shape. Ordinary thicknesses and lengths of lumber are glued together, face, side, and end, to create structural members of any design desired by the architect. Any size can be produced, the only practical limitation being the maximum dimensions that can be handled in transport. The members are made straight, tapered or curved to order. In some plant operations, laminations are drawn into one end of a machine and the laminated member emerges at the other end in a continuous ribbon, which is cut to desired lengths.

Glued laminated arches, beams, trusses and ribs are finding wide use today because of the building needs of this age, Bodine said.

"The skyscraper and the monumental building characterized the era of urban development," he said. "Now the trend is to decentralization—to spreading out instead of up, with attractive buildings appropriate to suburban settings. The wide spans provided by engineered timber construction give clear, post-free space. Also, today's architecture calls for expression of the beauty of a building in its structural form. Structural materials are used that do not have to be covered up. The combination of structural efficiency and the attractiveness of the material itself account for the upsurge of laminated wood construction.

"Its use ranges from the inspirational forms of church arches and beams to the striking modern design of theaters and supermarkets; from characterful new schools, auditoriums and field houses to the utilitarian and post-free interiors of hangars, warehouses, and factories."

The longest wood arches ever built frame the roof of the Union College Field House, Schenectady, N. Y. They are 254 feet along the arc and provide a 190 foot clear span.

The longest clear span for wood arches is 201.5 feet, provided by the arches in the Montana State University Field House.

The longest wood beams, 103 feet, are in the Shumway Junior High School, Vancouver, Wash.

The longest timber truss span has been achieved with bowstring trusses in a hanger at Westchester County Airport, White Plains, N. Y. The trusses span 248 feet, center to center of supports. The hangar is in three section with a total area equivalent to two football fields.

Participation in Science = Leadership

Youthful participation in science projects may be the stepping stone to leadership in science or engineering, Dr. John T. Rettaliata, MWSE, president of Illinois Institute of Technology, told 750 teen-age science enthusiasts May 3.

Speaking at the fifth annual Chicago Student Science Fair awards dinner at Austin high school, Rettaliata stressed the importance of such projects in uncovering talents and aptitudes in early life as a guide to future careers.

In congratulating the students on their achievements, the Illinois Tech president declared:

"You are learning to create and to build, and in the process some of you may be laying the foundation of future careers as leaders in science or engineering in which you will help bring about a still better way of life, and even stronger America, and a happier world."

Attending the dinner were representatives of the Chicago Board of Education and the Chicago Association of Commerce and Industry, which sponsored the fair; teachers and school advisors, and parents of the high school pupils.

Rettaliata emphasized the importance of high school courses in mathematics, English, and science as basic studies for students planning to pursue science or engineering in college.

He pointed out that the education of an engineer or a scientist begins in high school, and added that college officials "are all too familiar with cases of high school students who, when approaching graduation, decide they would like to pursue science or engineering in college, but find, too late, that they do not have the prerequisite courses."

The educator said a curriculum "which would give a proper background for a student intending to be a professional man in science or engineering" should include at least three years each of English and mathematics, and that four years were preferable.

He also advocated a minimum of two years of science, particularly chemistry and physics.

He told the teen-agers there are many job opportunities for graduates in science and engineering. He cited a heavy industrial demand at a time when the colleges and universities are producing several thousand fewer graduates than are needed each year.

He spoke of the many young men and women just graduating from our engineering and scientific colleges into positions that pay higher-than-average starting salaries.

"Practically all of them will be employed immediately after graduation, because, more than any other group, these young people with scientific and technological training offer something that industry needs and wants."

He said industry's current needs are estimated at about 30,000 new engineers a year, and this year's graduates at approximately 23,000. Only about 20,000 engineering students were graduated in 1954, he added.

Rettaliata told of the role of women in science and engineering, and expressed the opinion that many more of them are needed, especially as high school science teachers, whose ranks, he said, have been seriously depleted.

Accidental Injuries Said Lowest in 1954

Accidental injuries to workers last year (1954) were lower than in any year since the 1930's, despite the fact that total employment over the last 17-year period increased by one-third and total physical output approximately doubled, according to statistics revealed by William G. Caples, vice president of the Inland Steel Company of Chicago, and chairman of the National Association of Manufacturers' Committee on Employee Health and Benefits.

Caples pointed out that the new low figure on injuries and a record low figure on fatalities set last year directly reflects the heavy emphasis that industry is putting on health and safety programs to give their employees maximum protection during working hours.

"Of the estimated 1,860,000 disabling

injuries to American workers in 1954," Caples added, "only 390,000 of these injuries, less than one quarter of the total, were suffered by workers in manufacturing establishments. The occupations covered in the remainder of the total include agriculture, mining, construction, utilities, government, etc."

The statistics showed that the number of deaths resulting from work injuries was the lowest ever recorded. The record low of 14,000 deaths due to work injuries in 1954—of which only 2,000 occurred in manufacturing—continued the downward trend of fatalities covering the last two decades.

"These improvements in industrial safety," Caples reiterated, "are the result of continually increasing attention to the problem by business, by employees, by government, by unions and by various organizations in the field of safety. The favorable trends should encourage these groups to continue their strenuous efforts to achieve an even better safety record and further reduce the human cost of turning out goods and services."

CRERAR LIBRARY

News and Notes

Four leaders in Chicago business and industry were added to the Board of Directors of the Library early in June. The new members are Edward C. Logelin, Jr., vice president, U. S. Steel Corporation; Foster G. McGaw, founder, president and chairman of American Hospital Supply Corporation; John G. Searle, president and general manager, G. D. Searle & Company, manufacturing chemists; and Leonard P. Spacek, managing partner, Arthur Andersen & Company, accountants. Four present members of the Board, Chauncey B. Borland, S. DeWitt Clough, J. F. Dammann, and George R. Jones, under provisions of the By-Laws, became Honorary Directors of the Library.

* * *

Summer hours for the Library go into effect this month. From June 15 through Labor Day, the reading rooms will be open 9:30 a.m. to 5:30 p.m. Monday through Friday, remaining closed on Monday nights and Saturdays. The Library was thus open on Monday night, June 13, but it has been closed since Saturday, June 18.

* * *

A meeting of Crerar Library Associates and members of the Chicago Council, Navy League of the United States was held on June 9 under the joint sponsorship of the Library and the Chicago Council. The meeting was planned to take place during the time the Naval Research exhibits were still on display and the luncheon speaker was Rear Admiral F. R. Furth, Chief, Office of Naval Research, Washington, D. C. His subject was to be the research program of ONR.

Atomic Car Is "Old Hat"

The atomic-powered automobile of tomorrow was here yesterday—in principle.

So says C. E. Simmons, veteran bellwether of the Capital antique automobile enthusiasts, whose glistening 1923 Stanley Steamer was displayed at the May 5 dedication of the new Asphalt Institute building on the University of Maryland campus, College Park, Md.

"When the power of the atom is harnessed to the automobile it will be applied in a modern version of the steamer with a reciprocating engine," says Simmons. "Meanwhile, they should be refining and developing the old steam engine so, when the day arrives they can simply remove the steam boiler and install the atomic pile."

According to Simmons, who is frankly a Stanley Steamer aficionado, the shiny steam plant under the bonnet of his maroon speedster furnishes the most satisfactory power ever turned loose on the highway. He further contends that it is the logical reversion to type when a nugget of bursting atoms can be installed beneath the hood of the family car, replacing all the mechanical viscera that now pops and burbles.

"It's appropriate to note," added Simmons, "that the Stanley Steamer holds a few speed records of its own. The first man ever to travel faster than two miles a minute did it in a Stanley—and that was 'way back there in 1906."

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United States Is Cleanest Nation

Using detergents with new machines and techniques, the United States today outstrips the rest of the world in industrial cleanliness, according to William W. Niven, Jr., Midwest Research Institute, Kansas City, Mo.

Niven has estimated that some 25 pounds of "materials for attaining cleanliness" are now being used annually by and for each person in this country. Together with other experts in the field, he has assembled for the first time complete up-to-date data on detergents, methods, materials and equipment used in industrial cleaning. Findings have been published in a book entitled "Industrial Detergency" (Reinhold Publishing Co., New York).

"The constantly increasing per capita consumption of soaps and detergents in the United States surpasses all known records throughout the world," Niven said. "It constitutes one of the simplest and most accurate measures of the degree of a nation's development. One of the most profound testimonials to advancement of the human race is the ever increasing urge to be cleaner, personally, and to be surrounded by greater cleanliness."

Research resulting in the book was directed toward "helping people assigned in industry to meet the ever more exacting demands for cleanliness." It reveals new cleaning techniques developed in the laundry, dairy, food, beverage and textile industries. Four chapters, contributed by Howard M. Gadberry, senior chemical engineer of the Midwest Research Institute, are devoted to detergent materials, dry cleaning, dishwashing, and general industrial cleaning. One chapter, by Milo J. Stutzman, senior metallurgist at the Institute, is devoted to the metals industries.

Four other authorities contribute chapters to the book. They are Lee G. Johnston, American Institute of Laundering; Martin H. Gurley, Jr., The Duplan Corporation, Charlotte, N. C., on textile processing; John P. Greze, chief bacteriologist and sanitarian, Oakite Products, Inc., on foods and beverages; and John R. Perry, National Dairy Products Co., Inc., New York.

Summing up trends on general industrial cleaning, Mr. Gadberry states:

"More and more, management is thinking of cleaning operations as a production job. Cleaning methods are being studied and improved. Supervision is being intensified.

"Mechanized cleaning methods are increasingly improving the effectiveness and efficiency of industrial cleaning. However, there is still a great need for compact, automatic, scrubbing and rinsing equipment. Power spray and steam-detergent cleaning techniques are finding wider use in the cleaning of process equipment.

Engineering Societies Personnel Service, Inc.

New York Chicago Detroit San Francisco

These items are from information furnished by the Engineering Societies Personnel Service, Inc., Chicago. This SERVICE, operated on a co-operative, non-profit basis, is sponsored by the Western Society of Engineers and the national societies of Civil, Electrical, Mechanical and Mining and Metallurgical Engineers. Apply to ESPS, Chicago and the key number indicated. Prepared ENGINEERS AVAILABLE advertisements limited to 40 words, with typed resume attached may be submitted to ESPS Chicago by members of Western Society of Engineers at no charge.

OVER THE MANAGER'S DESK

The matter of the Chicago office developing a series of charts showing salary curves for the use of employers has been discussed by the Chicago Advisory Committee and it was decided to hold it in abeyance for further study. If and when the Committee decides to publish these charts we will keep you informed as to dates of availability and the amount of the annual subscription rate to be charged for this Service.

We are beginning to get registrations for summer work for students now, so if any of you who use students in the summer have your plans formulated enough to interview these young people, we will be glad to start working on the matter as soon as you furnish us with your specifications for the positions you have in mind.

June 29th will be the last Wednesday evening we are open until the Fall. We expect to resume the Wednesday evenings again on September 14th.

Bonnell H. Allen
Manager E.S.P.S.

POSITIONS AVAILABLE

C-3061 Sales Trainee — Chem. or Chem. Eng. Age: up to 40. Recent grads or better. Knowl: Biochemistry and foods. Duties: selling line of malts and allied products to breweries, pharmaceuticals and other industries. Recent grads. $350 a mo. and up. Men with exp. $625 to $875 per mo. depending on background. Mfger. of malt. Employer will pay fee. 30-50% traveling. Car required. Location: U.S.

C-3062 Sales Engineer ME EE IE Age: to 30. 2 plus yrs. exp. in sales and preferably pharmaceutical, plastics, molding or high vacuum equipment. Duties: sales of above named eqpt. to chemical and other processing industries. For mfg. process eqpt. $500 mo. plus bonus and expenses. Employer will negotiate fee. 50% traveling-home weekends. Car required. Location: Hdg. Chicago.

C-3072 Editor Electronics Recent Grads or better. Should be able to type and/or take shorthand. Knowledge of electronics. Duties: edit and rewrite technical reports, on research and development, write original reports and handle technical correspondence. For a radio mfger. Salary: $375 to $500 per month. Location: Chicago.

C-3079 Metallurgist Age: up to 40. 2 plus yrs. exp. in administrative and supervisory work on ferrous metals alloys in production functions on job shop forgings. Duties: assisting chief metallurgist on test work laboratory, customer contact and allied functions on ferrous forgings. For a mfger. of forgings and rolling mill. Salary: $550 to $650 per mo. Employer will pay fee. Location: Western Chicago suburb.

C-3082 Assayer—Tungsten Min. E. Met. Eng. or Chem. Eng. Age: 30 2 plus yrs. exp. in laboratory work on metal analyses and preferably non-ferrous. Duties: assisting chief assayer in running assays of tungsten and other metal. For a company mining tungsten. Sal: $400 to $450 per month. Employer will negotiate fee. Loc: North Carolina.

C-3086 Chief Ind. Age: up to 50. 5 plus yrs. exp. in supervising engineering dept. on heavy mechanical equipment. Must be good administrators. Good knowledge of combustion and mechanical engineering. Duties: supervise engineering dept. consisting of project, combustion, electrical, mechanical and product engineers on heavy industrial eqpt. For a mfger. of heavy indus. eqpt. Sal: $15,000 per yr. Poc: Penn.

C-3095 Project Engineer ME or EE 2 plus yrs. exp. in small product design or development such as small maintenance tools. Duties: develop and design new products, redesign old products. Some field work with customers. For a mfger. of el. maintenance tools. Sal: $450-$650 per mo. Employer will negotiate fee. Location: Illinois.

C-3102 Assistant Works Manager Age: 30-45. 5 plus yrs. exp. in die design for small stampings. Production exp. desirable. Knowledge of metals helpful. Duties: assisting Works Manager on production and personnel problems for a plant of about 100 employees. For a stampings' manufacturer. Sal: $150 to $175 per week. Employer will pay fee. Location: Chicago.

If placed in a position as a result of an Engineers Available or Position Available advertisement, applicants agree to pay the established placement fee. These rates are available on request and are sufficient to maintain an effective non-profit personnel service. A weekly bulletin of positions open is available to subscribers. Apply ESPS Chicago.

ENGINEERS AVAILABLE

Chief Engr. (212 MW) 34 ME 4 yrs. project eng. involving any steel mill activity. 4 yrs. supv. of metal fabrication & plating. 2 yrs. technical instructor. 4 yrs. resp. for production of metal furniture. $10,000 Midwest.

Res. Metallurgist (213 MW) 46 PhD Physics, Chemistry. 9 yrs. testing & devel. of precious metal alloys. 3 yrs. chemical boiler water treatment. 2 yrs. control of fermentation. 3 yrs. instructor in chemical dept. Midwest $6000.

Sales Engr. (214 MW) 55 EE 8 yrs. educating distributors and salesmen of special lubricants. 2 yrs. contacting yards and quarries for bldg. matl. mfgr. 1½ yrs. design of high tension power lines. 2 yrs. supv. all dept. production & shipments. $7200 Chicago.

Petr. Engr. (215 MW) 32 ME 8 yrs. in Pet. Ind. handling constr. project work, design, purchasing, costs & subcontracts. $7800 US.

Instr. Engr. (216 MW) 31 ChE 3½ yrs. asst. general foreman charge of instrument dept. 6 yrs. calculation & maintenance of mass spectrometer, infra red, ultra violet spectrograph, physical testing of grease. $7500 Midwest.

Purchasing (217 MW) 32 Bus. Adm. 53 mos. purchasing, supervising stock records & stock personnel, scheduling production. Resp. for job order cost system and standard cost system for paint mfgr. $6500 Midwest.

Sales Mgr. (218 MW) 36—9 yrs. selling of new cars, building materials to contractors and photo & recording eqpt. to schools, churches, institutions and in dustrial firms. $8000 Chicago.

Sales Engr. (219 MW) 48 IE 9 yrs. sales of tools & machine parts, office machines, and surplus tools and machinery from inventory work. 14 mos. industrial specialist doing plant survey work. $5000 Chicago.

Elec. Engr. (220 MW) 68 MS-EE & ME 2 yrs. design power plants & distr. for industrial plants. 5 yrs. el. plant engrg., lights & power distr. 38 yrs. research & development of el. apparatus, controls & appliances, planning & installations for industries. $8400 Chicago.

'Tooling Up' Is Never Complete

"Tooling up" programs in most American industries are almost never of permanent nature, the chief production engineer of Pratt & Whitney Aircraft Corporation declared recently.

The need for selection, design, and procurement of many thousands of different machine tools and other mechanical equipment said E. P. Bullard III of East Hartford, Conn., has risen tremendously with development of mass-production techniques. Such changes, whose costs account for a considerable proportion of the total national income, are almost never permanent because "our competitive system demands that the final product be constantly improved and constantly reduced in cost."

Bullard spoke at New York University before the 1955 Machine Design division conference of the American Society of Mechanical Engineers. One hundred and fifty engineers attended the national meeting, a part of the Centennial observance of the NYU College of Engineering.

In some cases, such as in the styling of automobile bodies, "there are strong indications that changes are sometimes made simply for their own sake, inasmuch as the public tends to become tired of an old product," Bullard said.

The more unskilled and semi-skilled labor that is used, the greater the need for special tooling, he said.

"Old-time craftsmen were able to produce almost any product with a very few fundamental tools, but these tools are almost useless in the hands of the novice.

"Consequently, it is necessary that the tools supply the need, skill and knowledge which the novice lacks."

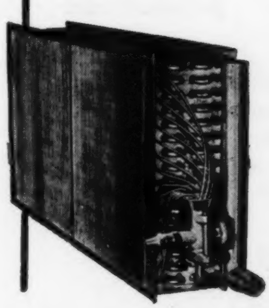
Since design accounts for about 10 per cent of the cost of building a new tool, he pointed out, designers can make considerable savings in over-all costs by increased attention to traditional design considerations.

He listed these as simplicity, actual use of equipment, adaptability to manufacture by general purpose rather than special equipment, economy in materials, and use of standard commercial elements and scrap material. Other considerations he cited are maximum use of standard dimensions, incorporation of simplified means of inspection in the part, and ease of handling and assembly.

Much unnecessary expense can be avoided, Bullard said, if the designer visualizes the manufacture of each part as he draws it. "Unusual shapes, such as ellipses, compound angles, and non-conventional forms, are almost always difficult and expensive to produce. It is perhaps unfortunate that the draftsman is supplied with French curves and drafting machines.

"With these tools in his hand, the draftsman sometimes fails to realize the difficulties encountered in producing in a piece of metal the lines which he so easily draws on his drafting board."

Assembly, while it usually represents a small proportion of total costs, presents some pitfalls, Bullard noted. Designers should be on guard against extremely difficult assembly operations.



On Training —
Letters from Leaders

In the last issue of Midwest Engineer we published another of about thirty letters received from leaders of Chicago-area firms concerning shortcomings noted in the engineers in their employ. Many of the letters also suggested what the engineers should do to correct their deficiencies.

Significantly, the engineer's technical training is generally considered adequate. In the broad area of Human Relations, however, engineers seem often to be "under achievers," according to the viewpoint of the industrial leaders as reflected in their letters.

We are printing another of these letters in this issue, as we shall do in future issues. Although the letters may be of greatest value to the younger engineers, we hope that all of the engineers who read them will benefit.

Here, then is the next letter:

Dear Mr. Becker:

This in in reply to your letter asking our opinion concerning "what education engineers need to be supervisors in engineering work and ultimately to advance into executive positions."

We have no criticism of the technical education of engineers—but too often it seems that this is, primarily, the only education that many of them have absorbed. As a result, when faced with supervisory responsibilities (which require education, training, and skill other than technical) many engineers have difficulty. The application of a technical engineering concept to human organization is sometimes tragic. The very phrase "human engineering," in its strictest sense, is a fallacy. The problem is, of course, that objective facts which are the usual and familiar tools of engineering must be interpreted for use in subjective situations. And it is in this interpretation that a balanced education is needed.

Specifically, it is our feeling that the technical education of engineers needs to be considerably bolstered with general educational courses, with liberal arts, social sciences, and human relations. A supervisor needs to be a "whole" man, over and above his specialist training.

Thank you for the opportunity of comment, and we wish you success in your program—it is certainly an important one.

Yours very truly,
(Signed)

Methods Sought to Decontaminate Water

The possibility of radioactive contamination of public water supplies from the use of nuclear weapons or from improper disposal of waste from atomic reactor installations, research organizations and hospitals has emphasized investigations of methods of dealing with such contamination.

Removal of radioactive contaminants from water by ion exchange slurry is among the latest of these methods tested by the Sanitary Engineering Branch of the Corps of Engineer's Research and Development Laboratories, Fort Belvoir, Virginia.

The method consists in removing the radioactive contaminants from the water by the addition of commercially available ion exchange resins. Attracted to the resins, the radioactive ions settle out with them after the solution has been agitated.

In the laboratory jar tests conducted by ERDL, the ion exchange resins were added to tap water contaminated with radioactive materials to a level approximating that expected in a water supply after the detonation of a nuclear type bomb.

Tests indicated that under certain conditions the ion exchange batch slurry treatment decontaminates radioactively contaminated water to a level suitable for emergency drinking purposes within 30 minutes. Because equilibrium is reached rapidly in the batch treatment it is faster, although sometimes less efficient, than the column type operation in which ion exchange materials are also used.

A Thought...

He that would catch Fish, must venture his Bait.—Poor Richard's Almanack

WSE Personals

B. J. Barmack, MWSE, senior engineer, Transmission Engineering Department, Commonwealth Edison Co., Chicago, has been awarded the ASTM Award of Merit by the American Society for Testing Materials. The Board of Directors of ASTM voted unanimously to present him with the award.

This is the sixth year that the award has been presented, and Barmack is one of 11 members of ASTM to whom the 1955 awards are being made. The award is in the form of a certificate which was to be presented to him during the annual meeting of the society in Atlantic City on June 28.

In ASTM, Barmack has been active since 1930 on Committee A-5 on Corrosion of Iron and Steel. He has also served on many of the sub-committees, and has been chairman of Sub-committee XIII on Hardware and Steel Transmission Towers for almost 15 years. He also served on additional committees dealing with fiber stresses of wood poles, electrical insulating materials, weatherproof wire, synthetic and rubber insulations for wires, galvanized strands, insulators, and many other items used in the distribution and transmission plants.

* * *

William V. Kahler, MWSE, it was reported in the last issue, was elected to the Board of Trustees of the University of Illinois. That was in error. Rather, he was elected to the Board of Trustees of the University of Chicago.

* * *

C. Earl Webb, MWSE, chief engineer, American Bridge Division, United States Steel Co., has retired. He served the company 41 years. Dr. Webb, who has been a trustee and 1st and 2nd vice-president of the Western Society, was the WSE president during the year 1943-44.

* * *

Arthur H. Wells, MWSE, president of John Griffiths & Son Construction Co., is chairman of the building and construction division of the Chicago Community Fund campaign for 1955. Wells supervised the building of the Federal Reserve Bank of Chicago, Mandel Brothers, the department store, and similar structures during his 50 years membership in the firm.

* * *

Mrs. Lois G. McDowell, MWSE, assistant professor of mechanical engineering at Illinois Institute of Technology, Chicago, has been elected national president of the Society of Women Engineers for 1955-56.

Mrs. McDowell, who served as national corresponding secretary for 1954-55, will assume the presidency on July 1.

The Society of Women Engineers is the national professional organization of graduate women engineers and women with equivalent engineering experience. Incorporated in 1952, the society has sections in 18 cities and three student chapters.

The newly-elected SWE president was the first woman to receive a master's degree in mechanical engineering at Illinois Institute of Technology and one of the first four women engineers accepted for training by Rensselaer Polytechnic Institute, Troy, N. Y. Of the three others who entered with her, only one other, a metallurgical engineer, completed the course of study.

Lois G. McDowell

At Rensselaer, Mrs. McDowell was named an honorary member of Tau Beta Pi, highest national engineering honorary society which accords full membership to men only. She also was elected to Pi Tau Sigma, national honorary mechanical engineering society, and Sigma Xi, national research society.

Mrs. McDowell received a graduate assistantship at Illinois Tech in 1946 and became a member of the IIT faculty in 1949 after receiving her M.A.

Other SWE officers elected for 1955 include: Dorothea H. Perry, Pittsburgh, Pa., vice president; Doris M. Gainor, Los Angeles, Calif., treasurer; Roslyn K. Gitlin, New York City, corresponding secretary; Martha J. Bergin, Boston, Mass., recording secretary; Miriam M. Gerla and Marie Reith, New York City, and **Dot Merrill,** MWSE, Chicago, directors-at-large.

Reviews of Technical Books

Aircraft Power Plants

Aircraft Power Plants, by Charles E. Chapel, R. D. Bent and J. L. McKinley of the Northrup Aeronautical Institute, McGraw-Hill Book Company, Inc., New York, N. Y., Revised Edition, 1955. 392 pages. Price $8.00.

This excellent big book with its hundreds of photographs, drawings, and diagrams is packed with detailed, easy-to-find, easy-to-read, up-to-date basic information on everything about aircraft engines from the principles of two-stroke cycle cylinder engines to the operating details of turboprop and turbojet powerplants.

There is a chapter on modern aircraft fuels and fuel systems. The treatment of carburetion begins with an explanation of Bernoulli's principle and concludes with a simple explanation of the intricacies of direct fuel injection. Superchargers, engine lubrication, starting, ignition, timing, and control systems get similar detailed treatment. Three chapters on propellers treat of theory and operation of airscrews from the wooden blade of the light plane to the complexities of the Curtiss electric propeller and the hydromatic reversing prop. Jet engines are accorded the same comprehensive treatment in 50 pages of text which include descriptions of the T34 and T40 turboprop engines and several turbojet engines including the J57.

In addition to the technical high school and college student, the aircraft mechanic will use this book for it contains information on installation, inspection, trouble shooting, and maintenance of the various engine systems.

J.C.B.

Properties of Soils

Engineering Properties of Soils, by R. H. Karol, Prentice-Hall, Inc., New York, N. Y., First Edition, 1955. 226 pages. Price $3.50.

Professor Karol of Newark College of Engineering is also a civil engineer for Esso Research and Engineering Company. His book is a paper-covered 8½ x 11 inch college workbook designed for use in soil testing laboratories by students with some knowledge of basic engineering and mathematics. Over half the sheets in the book are made to be torn out and used in recording data from the various experiments. The workbook was drawn up with several specific textbooks in mind, especially *Fundamentals of Soil Mechanics* by Taylor; *Soil Engineering* by Spangler and Grant; *The Mechanics of Engineering Soils* by Capper, Leonard, and Cassie; and *Soil Mechanics in Engineering Practice* by Terzaghi and Peck. Any well organized course in testing of soils, however, can be built up around this workbook.

There are 13 separate experiments, some with several parts. The student learns the techniques and procedures of determining: soil water content; specific gravity of soils; the relative amount of pore space in granular and cohesive soils; the size of soil grains by sieving and sedimentation; the liquid, plastic, and shrinkage limits (Atterburg) of soils; and soil classification. Further tests treat of soil permeability, and seepage, and of consolidation, compression, and shearing characteristics of various soils. Finally, tests for determining proper soil compaction and suitability for load-bearing are described.

J.C.B.

Heat Transfer

Conduction Heat Transfer, by P. J. Schneider, Addison-Wesley Publishing Company, Inc., Cambridge 42, Mass. 1955. 395 pages. Price $12.50.

The study of conduction heat-transfer is principally concerned with the distribution of temperature and temperature history within solid structures. In all cases it is the temperature distribution which determines the heat transfer and thermal stress. This book explains the four available methods for the evaluation of these temperature fields. Each method, the analytical, the graphical, numerical and experimental is given ample space and illustrations, charts and photographs make it very suitable for use as a text book in graduate-level courses.

The first chapters review the fundamental laws and characteristic differential equations which are particular to the conduction heat transfer. The later chapters deal with heat removal, problems of generated or absorbed heat and cooling of porous material by forced liquid or gas. The last part of the book explains calculations of temperature histories by a numerical procedure and experimental techniques for handling conduction problems. In each chapter numerical examples are presented, followed by many problems, with most answers included in the statement of the problems themselves.

This book can be of great interest to any engineer employed in the field of design of structures which must operate within allowable temperature limits, such as electrical coils, turbine blades, rocket-engine nozzles and nuclear reactors.

C.W., W.S.E.

WSE Secretary Is CESS Head

J. Earl Harrington, WSE executive secretary, was elected president of the Council of Engineering Society Secretaries at the 19th Annual Meeting held in Philadelphia May 24-25.

Other officers elected were:

Vice-president—T. J. Ess, Association of Iron and Steel Engineers

Secretary—C. S. Doerr, The Engineers' Club of Philadelphia

Treasurer—W. P. Youngclaus, American Society of Lubrication Engineers

Directors—E. H. Robie, American Institute of Mining and Metallurgical Engineers

A. R. Putnam, American Society of Tool Engineers

L. Austin Wright, Engineering Institute of Canada

William Evans, Engineers' Society of Milwaukee

Sixty-four societies comprising a total membership of 500,000 were represented at the two day meeting.

Panel and open forum discussions were held on all phases of society operations. Subjects discussed were—Publications: circulation, printing, distribution, advertising solicitation and circulation breakdown. Finances: budget, financial control, operating costs, dues and dues collections, securing support of industry, fund raising, taxes, headquarters operations. Society Improvement: function of an engineering society, public relations, publicity, employment service, inter-society relations and membership campaigns. Insurance: adequate cash coverage, premiums and benefits, employee pension plans and benefits. Miscellaneous: modern office procedures and equipment, promotional material, speakers and meetings.

Representatives attending the meeting from distance locations were L. Austin Wright of the Engineering Institute of Canada; K. H. Platt, Institution of Mechanical Engineers, London, England; and H. L. Woodward, Colorado Society of Engineers.

Chicago Architects, Firms, Win Awards

Four awards were won by Chicago architects and architectural firms in the Seventh Annual Competition for Outstanding American Architecture sponsored by The American Institute of Architects, Washington, D. C.

First Honor Awards were given for The General Telephone Company of the Southwest, San Angelo, Texas, and for the American Embassy in Stockholm, Sweden. Pace Associates was the architect for the Telephone Company with Charles B. Genther, architect-in-charge. Frank J. Kornacker & Associates, Chicago, was the structural engineer. Evans & Tyler of San Angelo was general contractor.

Ralph Rapson of Minneapolis was architect for the American Embassy and John van der Meulen of Chicago was associate architect. Sven Tyren was structural engineer and the firm of Ollie Engkvist & Nils Nessen was general contractor.

An Award of Merit was made for the Sigmund Kunstadter residence in Highland Park. George Fred Keck—William Keck of Chicago was the architect and Walter Olson, Chicago, was the contractor. Skidmore Owings and Merrill was given an Award of Merit for the Service Schools of the U. S. Navy at Great Lakes. Contractors were Wm. E. Schweitzer & Co., Evanston, and Engineering Construction Co., Chicago.

End Friends

When a Friend deals with a Friend, Let the bargain be clear and well penn'd, that they may continue Friends to the End.

—Poor Richard's Almanack

Argonne Studies Body Absorption

For the past two years, a group of scientists at Argonne National Laboratory has been conducting a study of the rate at which radium is incorporated into the human body from the small amounts present in natural drinking water and food. This element, similar to other natural and man-made radioactive elements, is a bone-seeker, like calcium, and once lodged in the bones is difficult to remove.

The study is a part of a large research program at Argonne concerning the retention of radioactive elements in the body. One of its major premises is that of establishing safe levels of exposure to radioactive isotopes. This, in turn, may conceivably lead to substantial savings in operation of nuclear installations and in industrial applications by eliminating unnecessarily stringent exposure and disposal levels. The program is under the general direction of L. D. Marinelli and John E. Rose of the Laboratory's Radiological Physics Division, Dr. Austin M. Brues of the Division of Biological and Medical Research, and Dr. Robert J. Hasterlik of the Argonne Cancer Research Hospital at The University of Chicago.

The first phase of the study has been completed. It involved the measuring of the amount of radioactivity in the breath of 50 inmates of the Illinois State Penitentiary (Stateville), *all of whom volunteered for the study*. Stateville was chosen because the natural concentration of radium in the drinking water of that region, although small, is one hundred times greater than the concentration in Chicago water, and because subjects who have been drinking that water for known lengths of time are available. The measurements at Stateville were devised and conducted by Dr. Andrew F. Stehney and Henry F. Lucas, Jr., chemists, of the Radiological Physics Division of the Laboratory.

The procedure for measuring the amount of radium in inmates utilized the fact that radium gives off a radioactive gas called radon. By measuring the amount of radon expired in the breath, the amount of radium in the body could be determined. Extremely sensitive techniques were developed at the Laboratory for this work, because the level of radium was much lower than had ever been measured in living humans. Since radon is a natural gas present in the atmosphere (natural radium in rocks, soil, and water gives off radon), inmates participating in the tests were required to breathe purified air for sixteen to eighteen hours in order to remove from their bodies atmospheric radon which had previously been inhaled. At the end of this period, the radon which continued to be produced by radium in the body was extracted from large volumes of breath by charcoal contained in glass vials (charcoal traps). These vials were then taken to Argonne where the radioactivity of the radon was measured. From this it was possible to calculate the amount of radium in the body. A comparison of the amount of radium

in each inmate with the length of time served at Stateville was used to indicate the rate of accumulation.

The research has shown that the amount of radium in inmates at Stateville is increasing at only one-half of the rate expected on the basis of previously published data. Although the natural radium content of the water is one hundred times that in Chicago water, inmates at Stateville after fifteen years have only five times as much radium in their bodies as have Chicago residents.

The research further indicated that the largest amount of radium found in any Stateville inmate is two hundred times less than the amount considered to be safe by the National Committee on Radiation Protection.

ASHAE Holds Semi-Annual Meet

Members and guests attending the Semi-Annual Meeting of the American Society of Heating and Air-Conditioning Engineers listened to technical reports on various research projects, as well as a symposium on evaporative cooling conducted by authorities in this field.

This meeting was held June 27, 28 and 29 in San Francisco at the St. Francis Hotel with registration beginning on Sunday and thereafter each morning until the concluding day. Meetings of the Council of the Society and various committees took place prior to and during this three day period. ASHAE president, John E. Haines, and first and second vice-presidents, John W. James and Peter B. Gordon, presided respectively at the opening of each of the sessions.

Subjects planned for the first session were the measuring of heat flow through a test house with an analogue computer, winter design temperatures in Canada, and the calculation of heat flow through a flat roof by direct measurement.

The amount of air required to keep workers comfortable in commercial laundries, an analysis of the cause of odors in air conditioning coils, and a report on the measurement and breakdown of dust particles sampled from the air in the laboratory, was the nature of the papers scheduled for the second session.

Arranged for the third session was a report on the presence and causes of gases in hot water heating systems, an explanation of a chart for designing cooling towers, a study of wooden louvers to determine reduction of frictional resistance to air flow, and how the sizing and location of room air outlets can change patterns of air movement.

As had been planned the Evaporative Cooling Symposium covered the following subjects: Historical, Air Cooling by Evaporation, Evaporation from Surfaces, Weather Data Limitations, Geographical Limitations, System Design, Indirect Systems, and Water Treatment.

A Thought . . .

Neglect kills Injuries, Revenge increases them.

—Poor Richard's Almanack

Automation Called Key to Good Living

Automation has been described as the key to keeping America's standard of living high while at the same time meeting the steadily increasing demands on her production facilities.

Donald C. Burnham, vice president in charge of manufacturing for Westinghouse Electric Corporation, told some 500 engineers attending the 19th annual Machine Tool Electrification Forum in Buffalo, N. Y., that Americans should not be concerned with "stemming the tide of automation but rather how to bring it about more quickly."

"Automation is something we cannot afford to neglect," Burnham declared. "In fact, it is a necessity. The working population and the total purchasing power of this nation are naturaly closely allied. Our gross national product is increasing at the rate of 3½ per cent a year. However, the American working population is increasing at the rate of only 1.8 per cent a year. Something has to take up the slack if we are to continue to be able to produce to the level required to improve our current standard of living. Automation is that something."

Historically, Burnham said, automation is not a revolutionary manufacturing concept but instead it is the "next logical step in a slow evolution." He explained that there are four major steps through which industry has passed since its birth: the job shop which is the highest cost method of production; progressive line manufacturing; conveyorized line manufacture; and finally, automation.

Citing the automotive industry as an example of the trend which has benefited the consumer, he said a $3,000 automobile today would cost approximately $100,000 if it were manufactured by job shop methods at the present labor rates.

In discussing future effects of automation, Burnham said:

"The effect of automation or any other technological advance on the very young and the yet unborn Americans is of tremendous moral importance. Their education will be increasingly more vital. Largely as a result of automation, people will have more time, more money and more need to go to school.

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Then why not drive to WSE meetings and other functions? There's plenty of PARKING almost at the door—the Underground Garage is diagonally across the street from WSE Headquarters (see the map below) and two private garages are a block west.

Interior view of Underground Garage

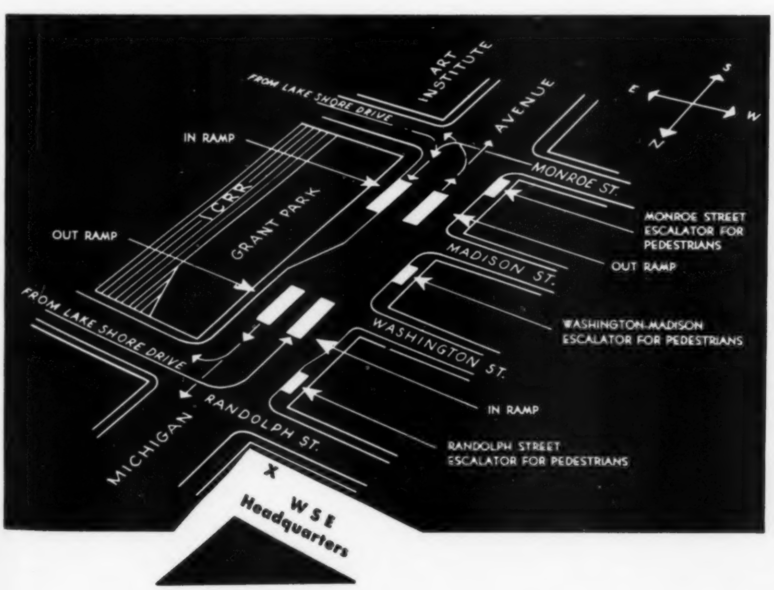
If you're not driving it's still convenient to get to and from WSE meetings.

Here are handy stations or stops:

- The Cab Stand is just across the street
- The Elevated is one block west
- The Subway is two blocks west
- Buses stop at the door or within a few blocks for every part of town
- The IC Suburban station is across the street
- Other suburban stations are conveniently served by bus or elevated.

You see, your WSE Headquarters is at the handiest place in Chicago.

Below: map showing Park Department Underground Garage



ENTER at either Monroe or Randolph Street on Michigan

EASY access, Speedy exit

ESCALATORS convey you to street level

CAPACITY The garage with its 2359 parking spaces, is designed to prevent overcrowding.